AMENDMENTS TO THE SPECIFICATION

Please add the following new heading and paragraph starting on page 1, line 1, immediately after the Title:

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application is a U.S. National Phase application of PCT/GB2004/003969, filed 20 September 2004, the entirety of which is incorporated herein by reference. This application also claims the benefit of British Patent Application No. 0321918.5 filed 19 September 2003.

Please add the following new heading starting on page 1, line 2:

TECHNICAL FIELD

Please add the following new heading starting on page 1, line 8:

BACKGROUND

Please replace the paragraph starting on page 4, line 4 with the following amended paragraph:

First, these systems generally assume that the object is a mirror normal to the optical axis, and sample a limited region (or in some cases regions) of the object under investigation. Localized topography of the sample can results in false readings. Reflectance variation of the sample, etc. can cause degradation of the focus information that is obtained, as it changes the character of the light beam that is being measured. There are many situations in which these degradations are not present or are negligible, and some of these auto-focus systems work very well within a limited context. However, in the case of overlay metrology the requirement to achieve extreme focus sensitivity necessitates elimination of as many potential sources of uncertainty as possible.

Please add the following new headings and amend the paragraphs starting on page 5, line 1:

SUMMARY

~~It is an object~~Several embodiments of the present invention to mitigate some or all of the above disadvantages of prior art auto-focus systems and methods.

~~It is a particular object~~For example, particular embodiments of the present invention ~~to~~ provide an auto-focus system and method in which the data required to determine an optimal focus point are acquired more rapidly and/or the collection of ultimately redundant focus data is minimised.

~~It is a particular object~~Another embodiment of the present invention ~~to~~ provides an auto-focus system and method which can use light with the same chromatic character for the focus beam as for the main observational beam, in particular enabling the use of a broad band light source and/or enabling the use of the same light source for a focusing and an observational step. Use of the same light source ensures that the ~~steps of~~ focus analysis and observation are carried out using light with identical chromatic characteristics.

DETAILED DESCRIPTION

~~The~~Several embodiments of the invention relates to focusing systems on microscopes having a light source, an objective lens or lens system, a ~~means~~light path to direct incident light through the objective lens or lens system to be reflected by the object, an aperture to limit the spatial extent of the incident light and serve as an illumination pupil, a ~~means~~light path to direct at least some of the reflected light to an imaging system, and an imaging system to image the reflected light so directed.

In accordance with selected embodiments of the invention ~~in its broadest aspect~~, a method of automatically focusing such a system comprises ~~the steps of~~ directing a beam of light from a light source through an objective of a microscope system to an object whereby light is reflected from the surface thereof; collecting at least some of the light reflected thereby and directing the same to an imaging system, wherein the incident beam of light is limited in spatial extent by imaging an aperture to form an illumination pupil, the centroid of illumination of the illumination pupil is aligned with the incident optical axis of the instrument, and reflected light is projected to the imaging system comprising at least two images, for example at least one pair of images, from eccentric sections of an imaging pupil differentially displaced from the optical axis, and wherein the separation of the images thereby produced is determined to provide an indication of the object distance.

Please replace the paragraph starting on page 6, line 15 with the following amended paragraph:

In accordance with additional examples of the invention, a novel focus system and method are described in which focus information is gathered during a focusing ~~step~~stage about the object distance by observation of the object upon which it is desired to focus during a subsequent observational (for example metrology) ~~step~~stage using the light source that is used by the optical system when it is performing its intended observational task.

Please replace the paragraph starting on page 7, line 5 with the following amended paragraph:

It will be understood to those skilled in the art of optical microscopy that if the imaging pupil in a reflecting microscope is eccentric with respect to a zero order projection of the illumination pupil then the image will move laterally with changes in focus conditions. ~~Only~~ bBy accurate centration of the illumination pupil, ~~can~~ the image can be made to remain stationary with changes of object distance. This statement should be refined slightly in the case where the illumination pupil is not a perfect circle or is not uniformly illuminated.

Under these circumstances, the fundamental required condition is that the centroid of illumination is placed on the optical axis. However, in the preferred case where the pupil is circular and evenly illuminated this will equate to a requirement that the pupil is centred on the optical axis.

Please replace the paragraph starting on page 8, line 5 with the following amended paragraph:

In one possible embodiment, the method comprises successively repeating the above outlined method ~~steps~~stages to obtain separate pairs of images from eccentric sections of the imaging pupil, measurements of the separation of the successive pairs of images being used, for example as part of iterative process, to improve the accuracy of the focusing information and/or to obtain focusing information varying spatially across an object, particularly to accommodate a degree of deviation from planarity. However, it will often be preferred if possible to determine in a single measuring stage the distance from focus, and to adjust in a single adjustment stage.

Please replace the paragraph starting on page 10, line 23 with the following amended paragraph:

Specifically, such a system for a microscope comprises a light source, an objective lens system, a ~~means~~light path to direct incident light through the objective lens to be reflected by the object, an aperture to limit the spatial extent of the incident light and serve as an illumination pupil with the centroid of illumination on the optical axis, a ~~means~~light path to direct reflected light from the object to an imaging system, and an imaging system, and the system further comprises ~~a means~~optics to project reflected light to the imaging system comprising at least two images from eccentric sections of an imaging pupil differentially displaced from the optical axis, and a ~~means~~camera to measure the separation of the images thereby produced to provide an indication of the object distance. Additionally there is a means to adjust mechanically the separation of the object being observed from the

imaging objective lens, under the control of the focus system. For example there is provided a closed loop control system which provides the ability to adjust the mechanical position of the object based on processing the output signal from the focus system detector.